NAVY WAR COLLEGE
Newport, Rhode Island

February 13, 1998

Seminar 6
Joint Military Operations

Nonlethal Weapons: Impact and Utility Concerns for Operational Commanders in Future Conflicts

by

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A paper submitted to the faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations. The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy

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Security Classification This Page: UNCLASSIFIED

REPORT DOCUMENTATION PAGE

1. Report Security Classification: UNCLASSIFIED	
2. Security Classification Authority: N/A	
3. Declassification/Downgrading Schedule: N/A	
4. Distribution/Availability of Report: DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.	
5. Name of Performing Organization: JOINT MILITARY OPERATIONS DEPARTMENT	
6. Office Symbol: C	**7. Address:** NAVAL WAR COLLEGE 686 CUSHING ROAD NEWPORT, RI 02841-1207
8. Title (Include Security Classification): Nonlethal Weapons: Impact and Utility Concerns for Operational Commanders in Future Conflicts (U)	
9. Personal Authors: Maj Kyle E. Garland, USAF	
10.Type of Report: FINAL	**11. Date of Report:** 13 February 1998
12.Page Count: 21	
13.Supplementary Notation: A paper submitted to the Faculty of the NWC in partial satisfaction of the requirements of the JMO Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC or the Department of the Navy.	
14. Ten key words that relate to your paper: Nonlethal Weapons, Disabling Weapons, Nonlethals, Electromagnetic Pulse, Isotropic Radiators, Supercaustics, Acoustics, Foams, Lasers, Computer viruses	

15.Abstract: The role of today's military in future conflict is far from certain. Rapid changes and instability in the world's political arena may thrust our military into a wide spectrum of conflicts at a moments notice. In order to meet this ever-present challenge, the United States military must constantly be prepared for any crisis. From peace operations to war, the U.S. armed forces represent the instrument of power that must never lose. The coalition military success in The Gulf War set the standard for future conflicts. The media portrayed a high-tech military capable of decisively defeating an able opponent in record time with few casualties. Unfortunately, the next conflict may not be so accommodating and the carnage of war could once again return to American living rooms. One avenue to avoid this, to attempt victory without fighting, is nonlethal weapons.

The role of nonlethal weapons in future conflicts is likely to increase on a continuous basis. Political and moral benefits, limited destruction, and the American public desire to avoid war casualties, will force increased development and employment of weapons that avoid killing. These weapons will offer the operational commander-in-chief (CINC) additional flexibility, thereby enhancing military effectiveness, in both war and operations other than war. The ultimate goal is to achieve victory, impose our will, or maintain the peace with as few American casualties as possible.

Nonlethal weapons cannot, however, be considered a panacea to cure the destruction caused by war. Many problems exist in the international community concerning their use. Current laws and treaties, possible negative impact on operational effectiveness, and ethical issues prohibit the employment of many non-lethal weapons. Additionally, some so-called non-lethal weapons may still result in death or permanent disability to their victims if used indiscriminately or incorrectly.

It is not my intent to delve into the tactical uses or capabilities of these weapons, but to concentrate on the operational and strategic issues that affects the theater CINC's decision to employ nonlethal weapons. Additionally, I am not suggesting that nonlethal military means should be developed *in lieu of* conventional forces, only as an adjunct to lethal force to achieve stated objectives. As a component of the informational instrument of power, nonlethal weapons may now serve as a bridge between the political and economic instruments, to be used before, or in conjunction with, the conventional military instrument. This paper will offer background, advantages, disadvantages, and operational concepts concerning the use of nonlethal weapons as applicable to theater CINC's. Finally, it will conclude with recommendations concerning the broad field of nonlethal weapons.

16.Distribution / Availability of Abstract:	**Unclassified** X	**Same As Rpt**	**DTIC Users**
17.Abstract Security Classification: UNCLASSIFIED			
18.Name of Responsible Individual: CHAIRMAN, JOINT MILITARY OPERATIONS DEPARTMENT			
19.Telephone: (401) 841-6461		**20.Office Symbol:** C	

Security Classification of This Page Unclassified

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Nonlethal Weapons

Those who win every battle are not really skillful-those who render others' armies helpless without fighting are the best of all.
Sun Tsu[2]

Nonlethal weapons have been called many different names over the years. Nonlethal defense, nondestructive, less-than-lethal, less lethal, sub-lethal, soft kill, mission kill, minimum force, and low collateral damage are all terms used to describe more or less the same types of weaponry. As each name may have a slightly different meaning, the term nonlethal weapons (NLW) will be generically used in this paper to reference all weapons of this type. NLW is defined as weapons whose intent is to nonlethally overwhelm an enemy's lethal force by destroying the aggressive capability of his weapons and temporarily neutralize his armed forces.[3] Additionally, the term "nonlethal" suggests that death cannot or will not occur when these weapons are employed; however, "nonlethal" is a description of *intent,* not guaranteed effect.

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[1] Except as necessary to illustrate an example.
[2] Sun Tsu, The Art of War, translated by Thomas Cleary (Boston: Shambhala, 1988), 67.
[3] Slightly modified from the definition used in "Weapons of Mass Protection," Air Power Journal, Janet Morris and others, Spring 1995, 24.

NLW can be broken down into three major categories of weapons: anti-personnel, anti-materiel, and anti-information systems. Each category contains weapons usable at all levels of war. For a sample of technology that has potential operational applications, see Appendix 1.

Background

Historically, the object of warfare has been to force the adversary to capitulate through large numbers of casualties and/or physical destruction. In order to accomplish this, warring nations have sought to increase weapon lethality to quickly dispose of enemy forces. From the sword to the crossbow, gunpowder to machine guns, and tanks to precision-guided nuclear missiles, weapons of war have evolved to a point where no one on earth is safe. From the capacity to destroy individuals and small units, existing weapons can now destroy entire cities, nations, and possibly civilizations. The death and mass destruction of these powerful weapons, I believe, has brought us to a climax. No longer can rational leaders deploy their own weapons on their adversary because of the reciprocal destruction they themselves would sustain in retaliation. The massive weapons of war have become unusable.

Beginning with the American Revolution, the United States has been involved in 10 major armed conflicts. These 10 wars/conflicts have resulted in 575,000 deaths among U.S. armed forces in battle alone, and 425,000 U.S. military deaths from other causes.[4] However, it wasn't until the Vietnam Conflict that America saw the harsh reality of war televised into their own homes on a nightly basis. The relentless media coverage of Vietnam caused a general revulsion among the American public for the actual conduct and results of warfare. This "CNN effect"[5] clearly contributed to anti-military sentiment and the public questioning of American involvement in Southeast Asia.

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[4] 1997 Defense Almanac, 43.

[5] Source of phrase unknown; used commonly in the 1990's to describe the important role media plays in influencing popular support.

More recently, America fought a war against a clear enemy, for a clear purpose, with clearly stated objectives. In contrast to the Vietnam Conflict, America now witnessed a professional force capable of minimizing war casualties by using precision strikes with technologically advanced weapons. Although The Gulf War was a military victory shared by all America, it will force the military to change the way we fight the next war. "The American public may now ***expect*** wars to be fought quickly and cleanly, with little or no damage to United States armament and equipment and no casualties for American forces" (emphasis added).[6]

Another important fact should be noted. Over the past 30 years, the Department of Defense (DOD) portion of the federal budget has dropped from a high of almost 40% in 1965 to a low of 16% in 1996.[7] Additionally, force structure has also dropped significantly. Since the end of the Vietnam Conflict in 1973, manning has dropped from almost 9 million to just under 1.5 million active duty forces.[8] These dwindling figures have somewhat leveled out in the last few years, but no significant rise in DOD spending or additional active duty troops is likely to occur in the near future.

These four factors: weapons of mass destruction (WMD), the "CNN effect," high American public expectations combined with an aversion to war casualties, and shrinking force structure, is forcing the military to re-think the way to fight future wars. In short, the armed forces must fight smarter, attempting not to do more with less, but to do the same with less. One tool in the commander's box for accomplishing this demanding goal is the employment of nonlethal weapons.

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[6] Paul G. O'Connor, "Waging Wars with Nonlethal Weapons," Challenge and Response: 334.
[7] 1997 Defense Almanac, 11.
[8] 1997 Defense Almanac, 17 & 43.

Advantages of Nonlethal Weapons

Nonlethality's allure is simple: between the moment when diplomacy fails and conventional military force is considered, the United States needs more options to either sending in a totally lethal force or accepting the status quo. Technology now offers such options, and they are life conserving, environmentally friendly, and fiscally responsible.
Janet Morris.[9]

Nonlethality is not a new concept, only one that has recently been thrust into the spotlight due to impressive footage of advanced weapons in The Gulf War. Dropping leaflets on Iraqi forces and shorting out electrical powerplants using Tomahawk launched attack missiles (TLAM's) with carbon-fiber filled warheads[10] are two examples of recent NLW usage. Usable throughout the entire spectrum of conflict, from peace operations to war, they provide the commander an effective and flexible tool. There are many advantages of NLW, among them are: controlled destruction, moral justification, political benefits, enhanced military effectiveness, and flexibility.

Controlled destruction: As the term suggests, it refers to direct targeting of a specific system, unit, or capability of the adversary in the hopes of limiting collateral damage. This can be contrasted with the indiscriminate effects on the civilian population of blanket economic sanctions. Unfortunately, expectations of a bloodless or damage-free war are unrealistic; unintended impacts on noncombatant populations will continue to occur. However, the effects of some NLW can be narrowly focused on the target group with the *intention* of neutralizing a specific target without destroying a city block. For example, as air launched cruise missiles (ALCM) are removed from their obsolete nuclear attack role, they are being retrofitted for use in a nonlethal role. By modifying their structural design to give them stealth characteristics and

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[9] Janet Morris, "Enter Nonlethal Weaponry," IEEE Spectrum 28 no. 9 Sep 1991, 58. Janet Morris is a member of the U.S. Global Strategy Council.

[10] The missiles dropped thousands of small reels of wire on transmission grids temporarily putting the powerplants out of commission. The Iraqi air defenses were then blinded and vulnerable to coalition destruction, but the powerplant was soon back in operation, softening the impact of the war on civilians.

loading them with a non-nuclear electromagnetic pulse (EMP) generator, they are now capable of producing a burst of microwaves powerful enough to disable all but special, radiation-hardened electronic devices.[11] The EMP weapon could disrupt electrical production, disable aircraft and vehicles, and knock out command and control facilities without a single death or any significant long-term physical destruction. Contrast the controlled destruction of an EMP device to the effects of conventional weapons used to do the same job, it is clear that the EMP is more cost-effective, controllable, and environmentally friendly.

Moral Justification: The elimination of killing by the use of NLW allows the U.S. to move conflict resolution to a higher moral plane by reducing the atrocities normally associated with war. The Vietnam-era oxymoron of "we had to destroy the village in order to save it," will never again be sanctioned in the international environment. Now commanders are tasked to limit noncombatant casualties and use the appropriate means for the situation at hand. Janet and Chris Morris of the U.S. Global Strategy Council argue that, as the only nation on earth with global military and political leverage, it is our responsibility to adopt a strategy of "containment of barbarism."[12] This proposed strategy requires intervention in situations where Western behavioral norms are violated, such as the "ethnic cleansing" in the former Yugoslavia. However, "containment of barbarism," the Morrises argue, cannot be achieved with U.S. barbarism; the tools of NLW must be used to suppress the deviant behavior. This, they suggest, will keep the U.S. on the moral high-ground and present our cause as just to the world community.

Political Benefits: The political benefits derived from NLW are numerous. Viewed by many as the global bully because of our active interventionism, American is often the target of

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[11] David A. Fulghum, "EMP Weapons Lead Race for Nonlethal Technology," Aviation Week & Space Technology, 24 May 93, 61.
[12] Janet Morris, "Nonlethality: A US Global Strategy Council Concept Paper."

flag burning protests in foreign nations. Even when U.S. intentions are to help people such as Operation RESTORE HOPE in Somalia, the U.S. evolved into a perceived enemy and many lives were lost as a result. Killing some of the people we were trying to save damaged our global image and, with help from the "CNN effect," caused public support to wane and the cause to be abandoned.

Nonlethal means can help alleviate the problems associated with these military operations other than war (MOOTW). Adversaries are acutely aware that the best way to defeat the U.S., or to change our strategy, is to inflict American casualties and allow the media to do the rest. If nonlethal means could avoid putting American troops in harms way, it could significantly reduce the media-exploitable casualties of war and MOOTW. If employment of nonlethal military means were successful, it could also reduce the anti-American sentiment that accompanies the use of lethal force. For example, forcing a hostile crowd to disperse using an acoustic weapon that temporarily incapacitates the crowd is not nearly as news worthy as American troops firing into a crowd leaving many dead and wounded.

Enhanced Military Effectiveness: Dr. John Alexander, program manager for nonlethal defense at Los Alamos National Laboratory, stated that "nonlethal systems should not be developed as stand-alone weapons [but] should be integrated into strategy and doctrine [and] supported by intelligence, C2, and lethal systems."[13] Integration of NLW with other military means could enhance effectiveness by giving the operational commander additional tools from which to choose to accomplish a specific objective. The underlying purpose, of course, is to give the commander another option rather than a force-on-force encounter. If nonlethal means can delay, disrupt, or disorient the enemy, it may not be necessary to destroy the enemy. If destruction is necessary, nonlethal means could be used initially to give the lethal means the

[13] Author not listed, cover story to Barbara Starr article, "Pentagon Maps Non-Lethal Options," International Defense Review. Jul 1994, 29.

advantage. For example, an acoustic or laser weapon could be used to slow or stop an advancing army while lethal counter-measures are taken. In summary, a fully integrated NLW program increases military effectiveness by allowing the operational commander to choose which weapon is best suited to accomplish the military objective.

Flexibility: Flexibility is another key characteristic of NLW. From pre-hostilities to post-hostilities, used in conjunction with other instruments of power or as a stand-alone weapon, in all out war or in MOOTW, NLW offer flexibility like no other weapon.

An example of the flexibility afforded by NLW can be illustrated by discussing an operational military objective such as an enemy integrated air defense system (IADS). Using lethal means, a CINC or Joint Force Air Component Commander (JFACC) could choose to target the defense network by using stealth aircraft armed with PGM's or TLAM's. Effective destruction of the system would include targeting the appropriate C2 node, supporting radar sights, and surface-to-air-missile or anti-aircraft batteries. Using this method, the objective of destroying the air defense system could definitely be achieved, but at what cost? Precision munitions and associated delivery platforms are extremely expensive; one lost pilot in an F-117 is far too costly and significantly outweighs the benefit.

If nonlethal means were employed, on the other hand, the CINC or JFACC has several options from which to choose. One option would be to use an unmanned aerial vehicle (UAV) carrying an EMP generator to destroy all but specially hardened electronic equipment. Another option might be "informational warfare," where a computer virus would be planted to disable the C2 and radar sights. Other options include conductive particles to short circuit unprotected electronics, embrittlement agents to destroy metallic hardware, or supercaustics to corrode metals.[14]

[14] See Appendix 1 for an expanded explanation of the nonlethal weaponry mentioned.

In the first scenario, troops are exposed to combat and the resources used are more expensive and destructive. In the second, the objective can be equally neutralized using distant computers or UAV's, exposing no troops to danger and using much less expensive weapons. Of course, the most likely scenario might be a combination of both options that best supports the overall objective, hence increased flexibility.

Controlling the amount of destruction, moral and political righteousness, enhanced military effectiveness, and flexibility are just some of the major advantages of using NLW in today's conflicts. Obviously, this list is far from exhaustive, it is only a sample of some of the added benefits that NLW can provide to a theater CINC. However, for a CINC to fully understand the complicated issues of integrating nonlethals into the military inventory, a look at the potential negative aspects must be included.

Disadvantages of Nonlethal Weapons

Kind-hearted people might of course think there was some ingenious way to disarm or defeat an enemy without too much bloodshed, and might imagine this is the true goal of the art of war. Pleasant as it sounds, it is a fallacy that must be exposed: war is such a dangerous business that the mistakes that come from kindness are the very worst. Carl Von Clausewitz.[15]

Misperception: As with most new technologies there are pros and cons; NLW is no exception. Even the politically attractive and somewhat misleading term "nonlethal weapons," is a fallacy in itself; the term is the root cause of the misperception that nonlethals won't kill. In many circumstances, the opposite is in fact true. An enemy aircrew would take little solace in the fact that an EMP destroyed their flight controls as they came crashing down to earth. Also, how friendly is it to drop supercaustic acid strong enough to corrode metal on unsuspecting ground personnel? Eliot A. Cohen summarizes the misperception well, "the most dangerous legacy of the Persian Gulf War [is] the fantasy of near-bloodless use of force."[16]

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[15] Carl Von Clausewitz, On War, translated and edited by Michael Howard and Peter Paret, 75.
[16] Eliot A. Cohen, "The Mystique of U.S. Air Power," Foreign Affairs (Jan/Feb 94), 121.

Militarily, this misperception would only be important if the will or support of the American people eroded or international condemnation occurred via the "CNN effect," However, as stated earlier, nonlethal military means should not be developed *in lieu of* conventional forces, only as an adjunct to lethal force to achieve military objectives. This affords the theater commander an additional and effective tool to be used when necessary, regardless of its' lethality.

International Treaties: NLW development and usage may potentially lead to legal violations of international treaties. Four international treaties are particularly relevant: The Biological Weapons Convention (BWC), The Chemical Weapons Convention (CWC), The Geneva Protocol of 1925, and The Certain Conventional Weapons Convention (also known as the Inhumane Weapons Convention).[17] The BWC prohibits the development, production, or possession of biological agents that have no justification for prophylactic, protective, or other peaceful purposes.[18] Using the strict definition of biological agent,[19] POL contaminants would definitely violate this treaty. The CWC prohibits the development, production, or retention of any chemical that can cause death, temporary incapacitation or permanent harm to humans or animals.[20] Calmative agents, supercaustics, depolymerizing agents, and liquid metal embrittlement agents threaten to violate the CWC. The Geneva Protocol of 1925 and the Certain Conventional Weapons Convention also threaten many NLW to include: supercaustics, POL contaminants, super lubricants, foams, calmative agents, lasers, pulsing lights, isotropic radiators, and acoustics. Almost every major category of NLW is affected by some international

[17] The full name of the treaty is "Convention on Prohibition or Restriction of the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects."

[18] Barbara Hatch Rosenberg, "Non-lethal Weapons may Violate Treaties," The Bulletin of the Atomic Scientists (Sep/Oct 94), 44.

[19] Defined as any microorganism capable of causing deterioration of food, water, equipment, supplies, or material of any kind; or deleterious alteration of the environment.

[20] Barbara Hatch Rosenberg, "Non-lethal Weapons may Violate Treaties," The Bulletin of the Atomic Scientists (Sep/Oct 94), 44.

treaty regardless of the level of injury inflicted. These constraints will not only severely tie the hands of the operational commander, in some cases it could force the CINC to be held legally accountable for violations that occur in their theater.

Moral Issues: A third disadvantage of NLW are the moral issues concerning their application. Ironically, as many advocates argue that NLW represent a more humane approach to military force, several moral issues arise in their wake. Using the earlier example of the Iraqi power grid knocked out by a carbon-filled TLAM, the impact on hospitals, water treatment plants, sewage systems, etc., was extremely serious and arguably fatal to many civilians. Additionally, today's near real-time media coverage will generate negative public opinion as blinded or handicapped civilians are shown as a result of NLW. Some of these moral issues can be placated if the indiscriminate effects of NLW and collateral civilian damage are minimized. Focused targeting and application of NLW solely on combatants and military targets will be essential in all future military operations.

Operational Impact: While the above described disadvantages can have an impact at all levels, some disadvantages would be strongest at the operational level of war.

a. **Elimination of surprise:** The use of nonlethal means as a first strike alerts the adversary that the conflict has begun and that lethal means may ensue. This advanced warning will be a detriment to operational surprise and could increase the risk to friendly forces if lethal means are subsequently used.

b. **Low-cost countermeasures:** History has proven that the development of effective countermeasures to new weapons occurs rapidly and usually at a lower cost. Simply putting a cover over an aircraft could negate the effect of embrittlement agents, depolymerizing agents, and conductive particles.

c. **Training and transportation burdens:** Employing a force that is proficient in both lethal and nonlethal warfare will increase both the training

requirements for personnel and the transportation necessary for the equipment. As air and sealift assets are already over-stretched, military commanders will be concerned that nonlethal capability may displace needed lethal capability. Theater commanders will fear getting caught bringing a computer disc to a gun fight.

d. **Invitation to micro-management:** Because tremendous amounts of information is known about each current operation, on-scene commanders' latitude in the execution of missions is increasingly subject to long distance scrutiny. Monday morning generals, politicians, and historians now have the ability to instantly critique the means used to accomplish the ends. If nonlethals are used when lethals should have been used, lives could be lost; if lethals are used when nonlethals should have been used, domestic and international support could be lost. The additional weapon category, designed to give added flexibility, could do just the opposite.

As stated earlier, these disadvantages of NLW are a mere sampling of issues that complicate NLW integration into military means. They are not meant to dissuade operational commanders from considering NLW application in contingency situations, only a means to keep nonlethals in perspective. Theater CINC's must be familiar with the positive and negative aspects of all selected weapons, and the ramifications of their use.

Operational Concepts

In recent history, military theorists such as J.F.C. Fuller, Liddell Hart, Guilio Douhet, and John Warden have argued that strategic paralysis, either directly or indirectly, should be the goal of armed forces. Each argument revolves around a specific weapon system and associated tactics best suited to accomplish the strategic goal. Champions of NLW, like Dr. John B. Alexander from Los Alamos National Laboratory, are no different.[21] As political and economic

[21] John B. Alexander, "Softer Response Required as Global Threats Change," National Defense Oct 93, 23-24.

instruments of power are used, nonlethal augmentation for strategic paralysis can be used prior to the application of conventional forces. Using John Warden's "Five-Ring Targeting Model" as an example, NLW can skip the outer rings of fielded forces and population if necessary, and hit directly at the inner three rings of leadership, organic essentials, and infrastructure.[22] Computer viruses, morphing, EMP generators, and selected NLW agents, can strike at these inner rings for an operational impact without a single bullet fired.

If, however, the situation evolves into a military operation (war or MOOTW), NLW can bridge the gap and be useful at all levels. From crowd control at the tactical level, IADS suppression at the operational level, and information warfare aimed at public will at the strategic level; nonlethal means can deny the adversary the ability to conduct a cohesive campaign.

As good as all this may sound, the theater CINC must still be concerned with some utility problems that exist with NLW use. The largest concern for widespread NLW use is that some employment tactics may still put friendly soldiers at risk.[23] A tactical skirmish where U.S. soldiers are killed or captured may have a strategic impact on domestic support. Additionally, due to their infancy, the nature and the impact of their effects are not well understood. Also, battle damage assessment is difficult and time required to achieve desired effects is mostly unknown. As these weapons are more commonly used and integrated into combined arms warfare, organizational knowledge will increase and unknowns will become known.

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[22] See Appendix 2 for a graphic presentation of Warden's Five-Ring Model adapted to nonlethal military means.

[23] Greg R. Schneider, "Nonlethal Weapons: Considerations for Decision Makers," Research paper for University of Illinois at Urbana, 31.

Recommendations

Due to their technological and doctrinal infancy, nonlethal military and informational means have yet to display their full potential in military operations. To reach this potential, continued research and development and employment exercises in the weapon field must be done. Recommendations to further the field of nonlethal weapons include:

- Combined research and development in the NLW field at the Joint Non-Lethal Weapons Directorate at Quantico, VA, and the Los Alamos National Laboratory in Los Alamos, NM
    - Open dialogue between these agencies to conclude which concepts are technically feasible and worthy of pursuit
    - Shared technological information between DOD organizations and national laboratories to eliminate duplication and create synergy
- Development and integration of joint NLW doctrine and tactics into current force employment
    - Ensure all services have access to nonlethal technologies that are applicable to their assigned roles and missions
    - Integrate nonlethal military means into computerized simulations for use across entire spectrum of military operations
    - Realistic field training and command post exercises to enhance practical NLW applicability
- Review of allied nonlethal capabilities for additional concepts and/or tactics
    - Open dialogue and shared nonlethal technology between United States and selected allied nations
    - Combined exercises and computerized simulations designed to test nonlethal interoperability, joint tactics, and command and control
- Identification of NLW that currently violate international treaties and resolution of such violations
    - Use Service Judge Advocates to identify violations and work internationally to modify treaty, or domestically to modify specified weapon into compliance
- Cooperative efforts between state and national law enforcement agencies and appropriate military commands for joint research and training

Conclusion

The world is rapidly changing. Growing global economies, interdependent with first world nations, will give the United States interests in many new and unstable places. At the same time, fiscal and political limitations will severely hamper our conventional power projection ability; crisis response will be increasingly difficult. This current void between the need to intervene and the financial inability to do so, must be filled. Technological advances in nonlethal weapons have the potential to fill this gap between sanctions and power projection.

Nonlethal military means have significant potential in providing options to theater CINC's. As a complimentary tool to lethal means, nonlethal weapon capabilities can be applied across the range of military operations to meet most any challenge. Increased military effectiveness, flexibility, political benefits, and moral advantages are just some of the benefits derived from nonlethal means. Their proper employment can limit casualties, minimize collateral damage, decrease environmental impact, and cost less than their conventional counterparts.

However, as the optimists see nonlethal weapons as a cure-all to the inhumanities of war, they must not be blinded to the inherent limitations and international ramifications of these weapons. "Nonlethal" sounds deceptively innocent; however, while the intent may be nonlethal, the effect can indeed be quite lethal. This misperception, combined with possible international treaty violations, moral issues, and operational utility concerns, are problems that must be dealt with concerning future NLW use.

In time, these new weapons may provide operational CINC's a revolutionary new approach to conduct military operations. As new ways are sought to resolve conflict quickly, decisively, and with minimum collateral damage, it is my conclusion that nonlethal weapons hold a key to success.

Appendix 1

NONLETHAL WEAPONS WITH POTENTIAL OPERATIONAL APPLICATIONS

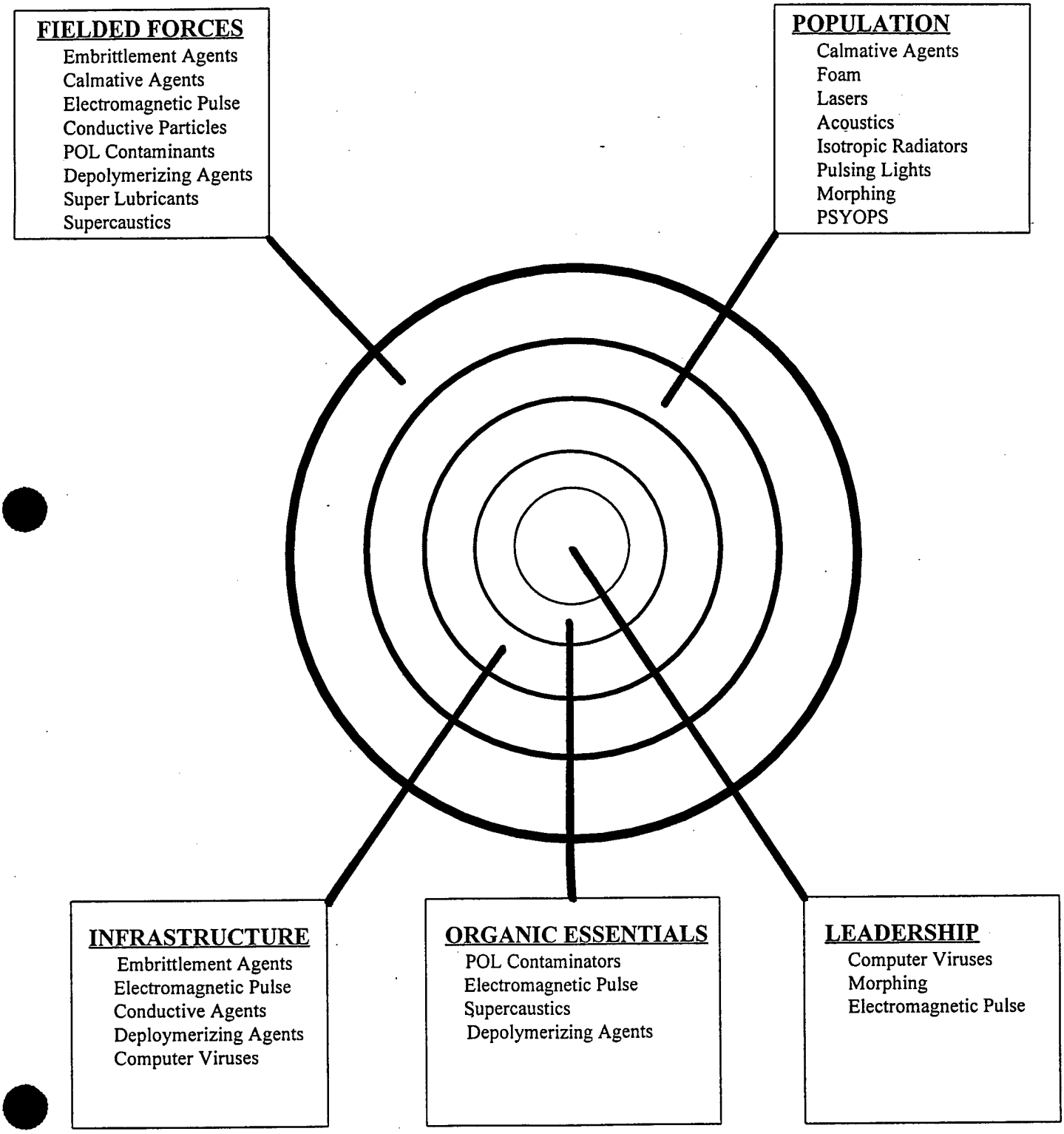
TECHNOLOGY	CATEGORY*	APPLICATION
COMPUTER VIRUSES	I	Computer codes or programs that can cause computer systems or networks to malfunction, to be controlled by external forces, or to be destroyed.
MORPHING	I	Use of electronic audio and video media to simulate speech mannerisms of an individual. Could be used as disinformation instrument.
CONDUCTIVE PARTICLES	M	Any of a variety of particles, dust, aerosols, or fabrics that can induce short circuits in electrical or electronic equipment.
DEPOLYMERIZING AGENTS	M	Chemicals that cause polymers to dissolve or decompose. Could clog air breathing engines. Adhesives could glue equipment in place.
LIQUID METAL EMBRITTLEMENT AGENTS	M	Agents that change the molecular structure of base metals or alloys, significantly reducing their strength. LME's could be used to attack critical metal structures--aircraft, ships, trucks, elevators, metal treads, or bridge supports
NON-NUCLEAR ELECTRO- MAGNETIC PULSE	M	Beam generators producing one gigiwatt of power could be used to explode ammunition dumps within line of sight or paralyze unprotected in-use electronic systems. Vulnerable systems include engine electronic ignition systems, radars, communications, navigation, and electronic triggers of explosive devices.
POL CONTAMINATORS	M	Additives that cause a fuel to gel or solidify, or change its combustion properties, making it unusable.
SUPERCAUSTICS	M	Acids that corrode, degrade, or rot structural material.
SUPER LUBRICANTS	M	Substances causing lack of traction. Delivered by aircraft or human agents, can render railroads, ramps, runways, and stairs inoperable for limited periods of time.
ACOUSTICS	P M	Very-low frequency sound (infrasound) generators that could be tuned to incapacitate humans, causing disorientation, nausea, vomiting, or uncontrolled bowel movements. At high power levels could have anti-material application.
FOAM	P M	Sticky or space-filling material that can impede mobility.
ISOTROPIC RADIATORS	P M	Modified conventional weapons that can fire omni-directional laser-bright rounds to dazzle people or optical sensors.
LASERS	P M	Low-energy lasers could flash-blind people and disable optical and infrared systems used for target acquisition, tracking, night vision and range-finding. High-energy lasers can blind or destroy optical sensors or navigational devices.
PULSING LIGHTS	P M	High-intensity flashing/stroboscopic light sources that can produce disorientation and confusion in personnel or degrade optical sensors.
CALMATIVE AGENTS	P	Chemical substances designed to temporarily incapacitate personnel.

* Categories: I = Anti-Information Systems, M = Anti-Materiel, P = Anti-Personnel

Source: Barry, John L. and others. *Nonlethal Military Means: New Leverage for a New Era.* 1994 Research Paper, John F. Kennedy School of Government. Harvard University: pp. 6.

Appendix 2

John A. Warden's
Five-Ring Targeting Model
Adapted for Nonlethal Military Means



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